ATLAS Status Summary
July 15, 2010

Bob Blair

Ongoing activities

- **Getting Physics Out**
  - Some early analyses using 900 GeV & 7 TeV data (COM and CONF notes)
  - Physics & performance studies
  - ATLAS Physics Coordinator
  - 3 summer students working with ATLAS data
  - ANL Tier3 support and development
- **Software and computing**
  - ATLAS Software and Computing
- **Detector Operations**
  - TDAQ operations
  - Tile operations
  - Tile LVPS development
- **Upgrades**
  - Study of ATCA platform for RoIB replacement

Getting Physics Out

Some early analysis using 900 GeV and 7 TeV data

- **Tracking underlying event studies with early data (900 GeV & 7 TeV)**
  - **second analysis using AOD and bin-by-bin corrections)**
  - https://twiki.cern.ch/twiki/bin/view/AtlasProtected/EarlyUE
  - Approved CONF Note (ICHEP10): ATL-COM-PHYS-2010-238/ATLAS-CONF-2010-029
  - Supporting notes:
    - ATL-COM-PHYS-2010-164, ATL-COM-PHYS-2010-237, ATL-COM-PHYS-2010-165
- **Studies of particle flow using calorimeter clusters in pp collisions at 900 GeV and 7 TeV with the ATLAS detector at the LHC**
  - **primary analysis**
  - https://twiki.cern.ch/twiki/bin/view/AtlasProtected/TopoClustersUE
  - ConfNote draft: ATL-COM-PHYS-2010-440
  - Supporting notes:
    - ATL-COM-PHYS-2010-210, ATL-COM-PHYS-2010-293, ATL-COM-PHYS-2010-351
- **Multiparticle correlations and fluctuations**
  - **Development of D3PD software package for KNO-scaling and factorial moment analysis**
  - https://twiki.cern.ch/twiki/bin/view/AtlasProtected/CorrelationsFluctuations
- **Properties of topoclusters for 900 GeV and 7 TeV MinBias data**
  - **Performance CONF note for locally-calibrated cluster (in preparation)**

Physics and Performance Areas: Ongoing

- Physics
  - **Underlying Event (Sergei + Jimmy +.)**
  - W+Jets (Sasha +.)
  - Boosted Tops (Sergei + Jimmy +.)
  - Prompt Photon (Bob + Sergei +.)
  - **Jet Inclusive cross section (Esteban +.)**
  - Correlations and Fluctuations (Sergei +.)
  - Double Parton Scattering (Tom + Belen + Bob +.)

- Performance
  - Calorimeter response (Jinlong + Jimmy +.)
  - Jet Energy Calibration (Belen +.)
  - Properties of topoclusters (Sergei + Jimmy + Jinlong +.)

Summer Students

- **Craig Levy**
  - Development of a C++ package for jet-shapes to identify boosted tops
  - To be used for searches of TeV-scale particles decaying to tt\bar
  - Alternative to the Principle Component Analysis used in
    - S.Chekanov and J.Proudfoot, Phys. Rev. D 81, 114038 (2010), hep-ph/1002.3982
  - The new method will include 5 new shape variables
  - During the Fall Program, will continue with detector-simulated MC and possibly with data
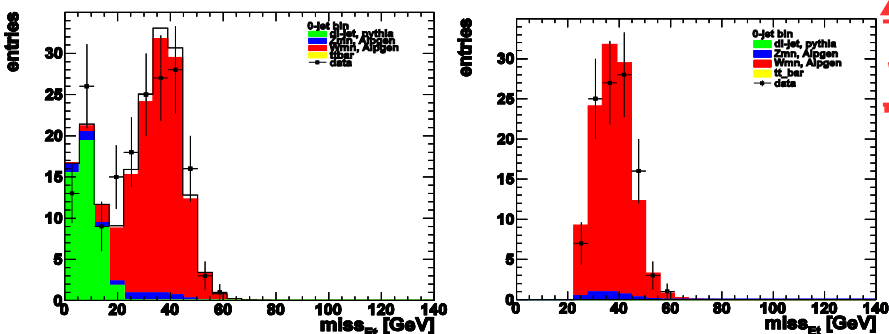- **Zach Epstein**
  - K0 analysis using 7 TeV D3PD data
  - Optimize K0s cuts to increase S/B
  - Reconstruct K0s pT, Eta shapes. Comparison with MC
  - K0sK0s invariant mass and (possibly) Λ/Λ(bar) ratios
- **Andrew Johnson**
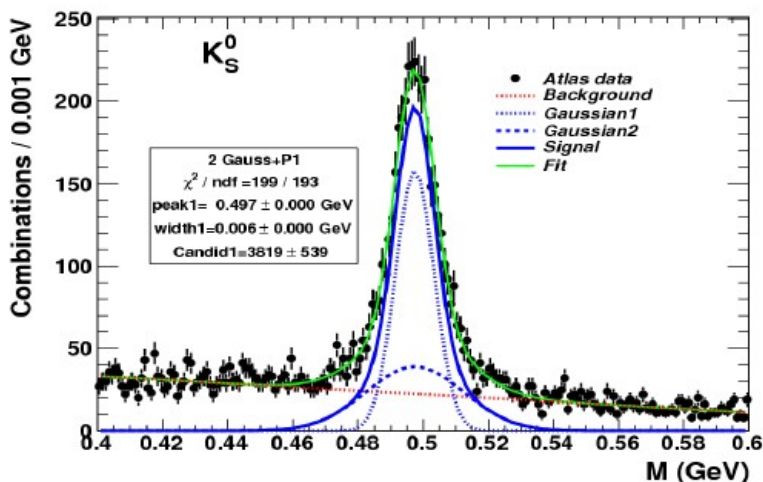 - Work on W+jet using missing Et
  - Currently at CERN for 3 weeks

Student Projects (very impressive)
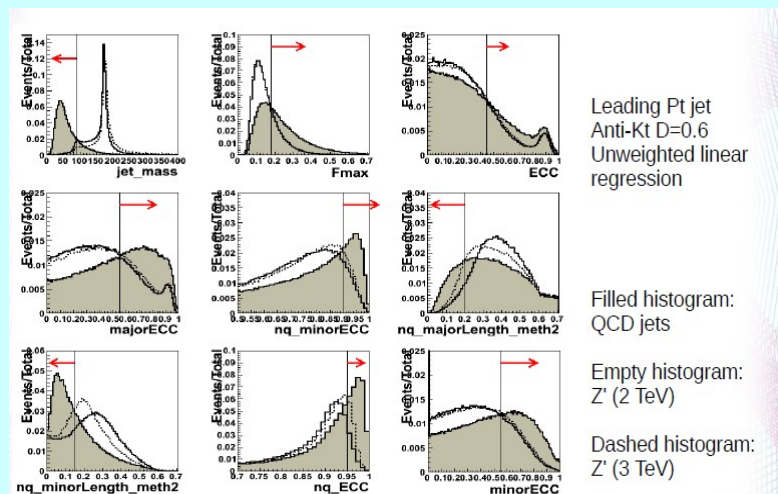
Andrew: W->μν plus jets

Missing Et, 0-jet bin

Before Cut (Control region: no cuts on missing Et or M_T)

After Cut (Signal region: Mu_Pt > 25 GeV, M_T > 20 Gev)

Leading Pt jet
Anti-Kt D=0.6
Unweighted linear regression

Filled histogram: QCD jets

Empty histogram: Z' (2 TeV)

Dashed histogram: Z' (3 TeV)

Craig: **New physics searches using jet shape variables**

Zach: K^0_S production

ATLAS Physics Coordination – Physics Coordinator Tom LeCompte – a man with a particularly demanding challenge

- Shepherds all results through the approval process
- Reads and approves every CONFerence note.
- Reads and approves every PUBlic note (mostly sensitivity studies)
- Ensures consistency across results.
- Prioritizes competing claims on resources

- Assigns ATLAS internal referees
- Provides input to ATLAS operational decisions (the "run plan") and trigger decisions (the "menu")
- Reads and approves every proceedings sent to conferences (about 300/year)
- Reviews all slides for conferences (also about 300/year)
- Provides input to conferences on expected ATLAS talks.
- Fields questions from the media
- Interacts with the LHCC and similar bodies reviewing ATLAS
- And, of course **"other duties as assigned"**.

ATLAS Status Summary, Bob Blair

Results to Conferences (I)

45 ATLAS results (+200 additional plots) are documented in "CONFerence notes."

- Jet kinematic distributions in proton-proton collisions at $\sqrt{s}=$900~GeV with the ATLAS detector
- Reconstruction of jets from tracks in proton-proton collisions at centre-of-mass energy $\sqrt{s}=900$ GeV with the ATLAS detector
- Tracking studies for b-tagging with 900 GeV collision data with the ATLAS detector
- Performance of the ATLAS Secondary Vertex b-tagging Algorithm in 900 GeV Collision Data
- Electron and photon reconstruction and identification in ATLAS: expected performance at high energy and results at 900 GeV
- Performance of the ATLAS electromagnetic calorimeter for $\pi^0\to\gamma\gamma$ and $\eta\to\gamma\gamma$ events
- Photon Conversions at $\sqrt{s} = 900\GeV$ measured with the ATLAS Detector
- Performance of the missing transverse energy reconstruction in minimum bias events at $\sqrt{s}$ of
- 900~GeV and 2.36~TeV with the ATLAS detector
- Estimating Track Momentum Resolution in Minimum Bias Events using Simulation and K_s in sqrt(s) = 900 GeV collision data
- First look at the JetProb b-tagging algorithm in the 900 GeV collision data with the ATLAS detector
- Tracking Results and Comparison to Monte Carlo simulation at $\sqrt{s} = 900$~GeV
- Commissioning of the ATLAS Tau-Lepton Reconstruction Using 900 GeV Minimum-Bias Data
- ATLAS Muon Trigger Performance in cosmic rays and pp collisions at $\sqrt s = 900$ GeV
- Performance of the ATLAS Inner Detector Trigger algorithms in p-p collisions at $\sqrt{s}=900$ GeV
- Identification of muon candidates in pp collisions at sqrt(s) = 900 GeV with the ATLAS detector
- Inputs to Jet Reconstruction and Calibration with the ATLAS Detector Using Proton-Proton Collisions at sqrt (s)=900 GeV
- Response of the ATLAS calorimeters to single isolated hadrons produced in proton--proton collisions at a center-of-mass ene sqrt(s) = 900 GeV
- Properties and internal structure of jets produced in proton-proton collisions at $\sqrt{s}=900~$GeV
- Study of the Material Budget in the ATLAS Inner Detector with Kshort decays in collision data at sqrt(s)=900 GeV
- Measurement of the missing transverse momentum based on tracks in proton-proton collisions at $\sqrt{s}=900$~GeV centre-of-mass energy with the ATLAS detector
- Performance of the ATLAS tau trigger in p-p collisions at $\sqrt{s} = 900$ GeV
- Performance of the Electron and Photon Trigger in p-p Collisions at sqrt(s) = 900 GeV
- $\Phi (1020)$-meson production in $\sqrt{s} = 900$~GeV collision data

Results to Conferences (II)

- **Charged particle multiplicities in pp interactions at sqrt(s) = 7 TeV measured with the ATLAS detector at the LHC**
- **Performance of the Minimum Bias Trigger in p-p Collisions at sqrt(s) = 900 GeV**
- **The ATLAS missing E_T trigger performance with initial LHC runs at sqrt(s)=900 GeV**
- **Characterization of Interaction-Point Beam Parameters Using the pp Event-Vertex Distribution Reconstructed in the ATLAS**
- **Performance of the ATLAS jet trigger with pp collisions at sqrt(s)=900GeV**
- **Track-based underlying event measurements in pp collisions at sqrt(s) = 900GeV and 7 TeV with the ATLAS Detector at the LHC**
- **ATLAS High Level Calorimeter Trigger Software Performance for First LHC Collision Events**
- **Charged particle multiplicities in pp interactions at sqrt(s) = 0.9 and 7 TeV in a diffractive limited phase-space measured with the ATLAS detector at the LHC and new PYTHIA6 tune**
- **Observation of Xi, Omega baryons and K*(890) meson production at sqrt{s}=7 TeV**
- **Kinematic Distributions of Kshort and Lambda decays in collision data at sqrt(s) = 7 TeV**
- **D^(*) mesons reconstruction in pp collisions at sqrt{s} = 7 TeV**
- **Preliminary studies for the measurement of the inclusive muon spectrum in pp collisions at √s=7 TeV with the ATLAS detector**
- **Muon Performance in Minimum Bias pp Collision Data at √s=7 TeV with ATLAS**
- **Probing the response of the ATLAS electromagnetic calorimeter and material upstream with energy flow from $\sqrt{s}=$7~TeV minimum bias events**
- **Data-Quality Requirements and Event Cleaning for Jets and Missing Transverse Energy Reconstruction with the ATLAS Dete sqrt(s)=7 TeV**
- **Performance of the missing transverse energy reconstruction in minimum bias collisions at center-of-mass energy of sqrt(s)=7 TeV with the ATLAS detector**
- **Tracking Studies for b-tagging with 7 TeV Collision Data with the ATLAS Detector**
- **Impact parameter-based b-tagging algorithms in the 7 TeV collision data with the ATLAS detector: the TrackCounting and JetProb algorithms**
- **Performance of the ATLAS Secondary Vertex b-tagging Algorithm in 7~TeV Collision Data**
- **Observation of Energetic Jets in pp Collisions at sqrt(s) = 7 TeV using the ATLAS Experiment at the LHC**
- **Observation of W->lnu and Z->ll production in proton-proton collisions at sqrt(s) = 7 TeV with the ATLAS detector**
- **First observation of the J/ψ→μ+μ- resonance in ATLAS pp collisions at √s = 7 TeV**

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These results range from being performance-based to physics:
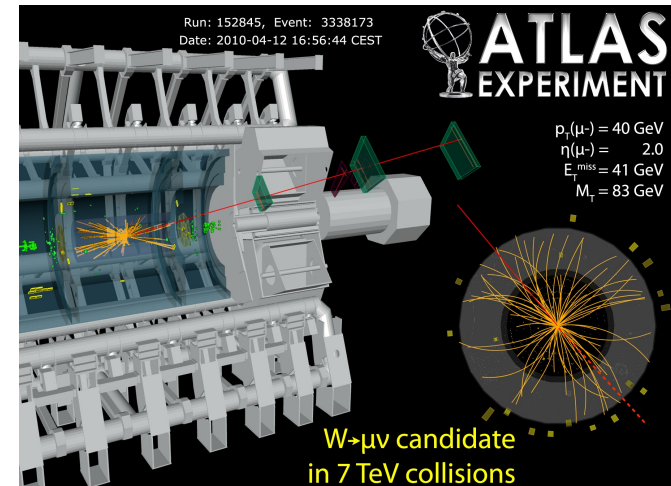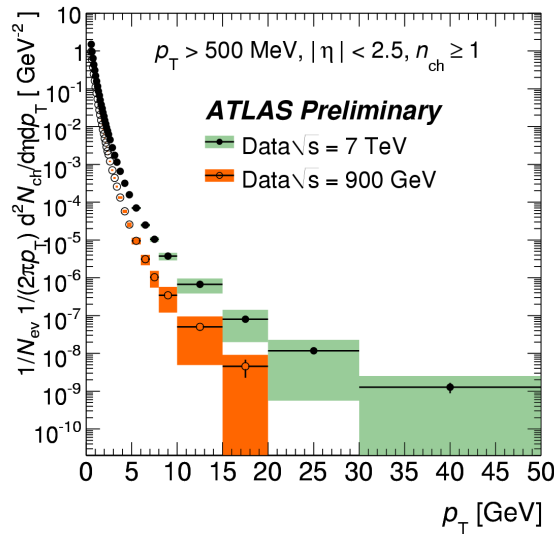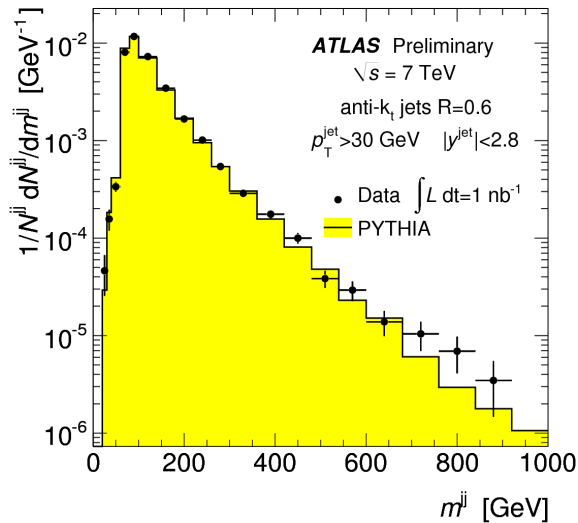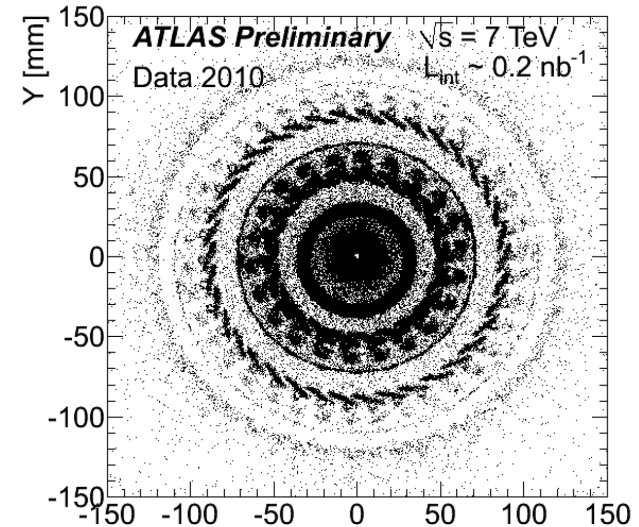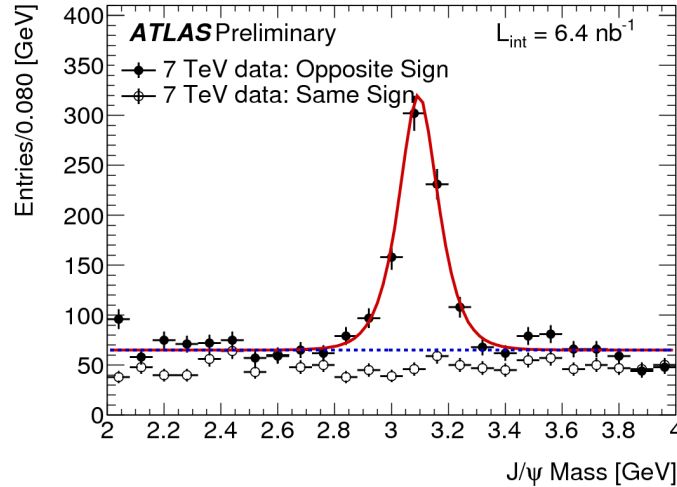
Results for Upcoming Conferences

- We have 41 notes in the pipeline for ICHEP
  - Evolutionary:
    - What was an observation for PLHC is a cross-section for ICHEP
    - Qualitative agreement for PLHC becomes quantitative for ICHEP
    - Starting to see lower cross-section processes (e.g. J/ψ for PLHC, upsilon for ICHEP)
  - Revolutionary:
    - Our first limits from searches will be shown.
    - This is why we built ATLAS.

- We have 30 notes in the pipeline for HCP
  - If all goes well, we collect enough data for sensitivity beyond the Tevatron limits for a (very) small class of models: q^*, Λ_{qqqq}, etc.

- We have 2 papers based on collision data published/accepted for publication
- We have 5 papers that will be submitted shortly after ICHEP
- We expect another ~10 additional papers to be submitted 4-6 weeks later

ANL-ATLAS Computer Farm Usage

- **~100 total ASC users, ~10 users running on the ANL cluster on weekly basis**
- **The PC farm is loaded with D3PD, AOD, ESD, MC truth ntuples**
    - All 900 GeV AOD/D3PD data and a fraction of 7 TeV data in D3PD format
- **900 GeV & 7 TeV studies using the PC farm:**
    - Direct photons (mainly AOD/D3PD analysis, NLO QCD calculations)
    - UE using tracks (running over AOD and D3PD, MC truth)
    - UE using topoclusters and topocluster performance studies (AOD, MC truth)
    - Correlations studies (D3PD)
    - W+jet (AOD, testing jet-area calculations)
    - Jet cross sections (MC truth ntuples)
    - K0 studies (MinBias D3PD)
- **Other studies are typically using interactive nodes (running over small ROOT ntuples)**

ATLAS Tier3 Effort at ANL

US ATLAS Tier3 coordination is at ANL ASC. (R. Yoshida, ANL and D. Benjamin, Duke)

From last Oct to Feb:

Oct 09, initial organizational meeting to define aims. Standalone T3's at ~ 40 US ATLAS institutes receiving ARRA funds to be established.   Standard design and organization to support them.

Contact and working together with US ATLAS facilities, OSG, VDT, CONDOR, XrootD teams.

Contact with vendor (DELL) to coordinate hardware recommendation.

Contact with international ATLAS community. Kickoff organizational meeting at CERN in Jan 10. Agree on working groups to establish T3 guidelines.

Begin to design and build a prototype T3 conforming to the ATLAS guideline.

More details up to this point in the slides for AS visit on Feb. (in agenda server)

Progress since Feb.→

ATLAS Tier3 Effort at ANL

The ATLAS T3 working groups have reached conclusions (final report this week at CERN)

Prototype Tier3 (conforming to ATLAS guidelines) ready here at ANL ASC. Has all desired functionality

Installation procedure ready (instructions being worked on): expect << 1 FTE-week for building effort per Tier3 after hardware and infrastructure on hand.

Expect < 0.25 FTE for maintenance.

Coordination offloads ATLAS software support to one ATLAS wide operation.

Held a US ATLAS T3 meeting in June & presented the "final" T3 design to the institutes receiving ARRA funds. 40 attendees with most institutes represented.

The ARRA funds still have not reached the Universities.

Some remarks:

The US ATLAS T3 effort is now a part of the ATLAS T3 effort. Everything being done here will be a model for any ATLAS T3. This is important for the ultimate success of US ATLAS T3's.

ANL ASC had the necessary resources to pull this off.

- Equipment funding
- Expertise
- Hosting facilities for meetings and guests

The ATLAS Computing Group at Argonne

Five PhD computational scientists and software engineers led by David Malon.

Argonne has leadership in scalable event store infrastructure, metadata, and distributed database services

Our physics and performance studies provide direct experience with the infrastructure in areas such as

- readability of data throughout the lifetime of ATLAS, even as data models, data structures and storage technologies change
- I/O performance and storage footprint optimization to maximize physics analysis throughput
- metadata storage and retrieval to understand provenance and support robust cross-section calculation, even under error or missing-data conditions in distributed environments
- access to supporting non-event data at Tier 2 and Tier 3 institutions: Luminosity, data quality updates; conditions data as needed
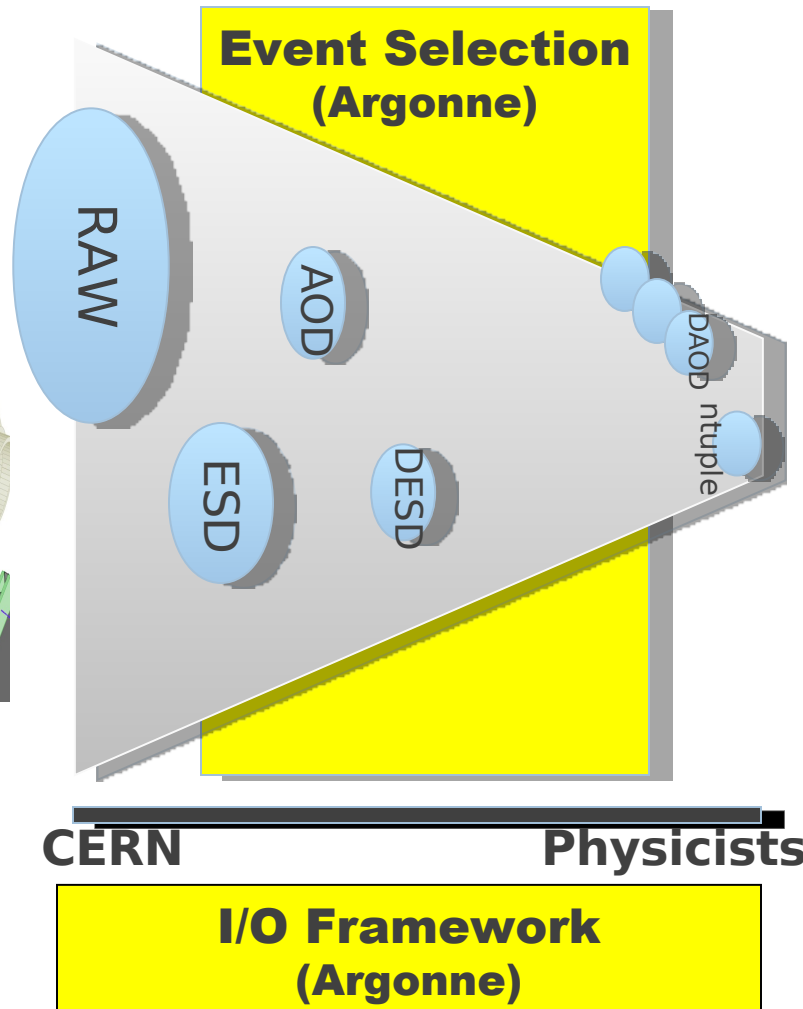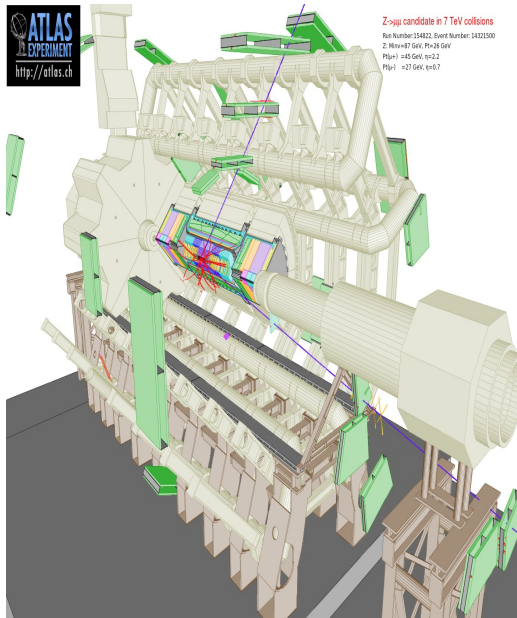
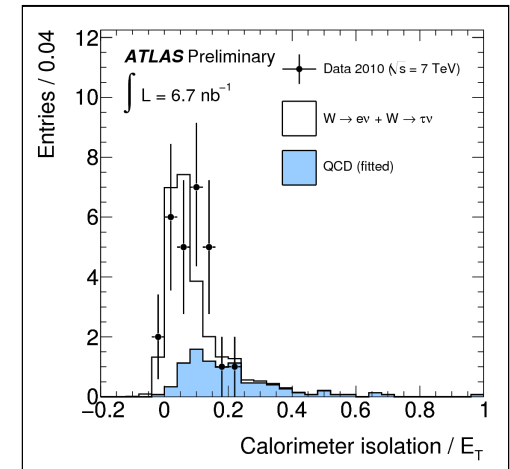*Faced the challenge of real data and performing as designed.*

ATLAS Data
→ From Collisions to Physics

Collisions

Physics
Results

Event Selection
(Argonne)

RAW

AOD

ESD

DESD

DAOD

ntuple

CERN   Physicists

I/O Framework
(Argonne)

Examples of Recent Activities

- Event Store
  - Adapt metadata handling to handle extreme sparsification of data where files end up with zero events but critical metadata must be retained.
  - Improve read performance for event data. Improvements of up to 300% have been achieved in some cases.
- Distributed Databases
  - Database releases are used to distribute critical configuration information used for simulations and reconstruction. This has been upgraded to make it more scalable and tested successfully in the April/May reprocessings.
  - Distribution of TAG data to sites worldwide has been stable, and the distribution successfully acted as a fallback when CERN had database problems in May.
- Metadata
  - Event selection based on metadata continues to become more important as data volumes increase. A variety of new tools and capabilities (event picking, multi-DB services, …) have been developed in collaboration with users.
  - During detector commissioning activities certain metadata that was not part of normal physics streams was developed. Rather than discard this after commissioning, useful pieces of this were integrated into the metadata from physics streams.

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New Initiative: Scalable data-intensive computing on emerging architectures

- **We propose an integrated program of research and development to address an array of challenges to successful exploitation of leadership computing platforms and emerging hardware architectures by data-intensive computational high energy physics.**
  - "Context-aware" scalable I/O;
  - Data organization and persistence technologies for emerging and heterogeneous architectures;
  - I/O frameworks for exploitation of emerging architectures.
  - Initial effort level of 0.5 FTE (HEP software engineer) plus one postdoctoral appointment
- **Proposed work is described in latest FWP (February 2010)**
- **White paper sent May 2010 (to Amber Boehnlein)**

Papers being presented at CHEP 2010

- **Optimization and Performance Measurements of ROOT-based Data Formats in the ATLAS Experiment**
- **Engineering the ATLAS TAG Browser**
- **Scaling up ATLAS Database Release Technology for the LHC Long Run**
- **Composing Distributed Services for Selection and Retrieval of Event Data in the ATLAS Experiment**

Detector Operations

- Tile
- TDAQ
- Software and Computing

TileCal Maintenance and Operations

- Low Voltage Power Supply Maintenance and Repair
  - System of 256 supplies, each providing 8 voltages (1 "brick" per voltage) , provides operating power to the 256 "drawers" of electronics, which provide all on detector readout of the Tile Calorimeter
  - Argonne is the principal institute for LVPS maintenance, though we were not the original builders of the system
  - Maintenance and upgrade of LVPS test lab at CERN
  - Active participation in Tile Data Quality Monitoring and DQM leadership
- TileCal shifts in ATLAS Control Room and monitoring (often remotely)
- TileCal software maintenance and development - Andrei Artamonov is one of two full time people providing software development and maintenance for TileCal codes
  - LVPS tracking database, Conditions database, management of energy reconstruction constants
  - code speed up, bug fixes etc.

TileCal Low Voltage Power Supply Replacement

TileCal LVPS box containing 8 voltage-supply bricks
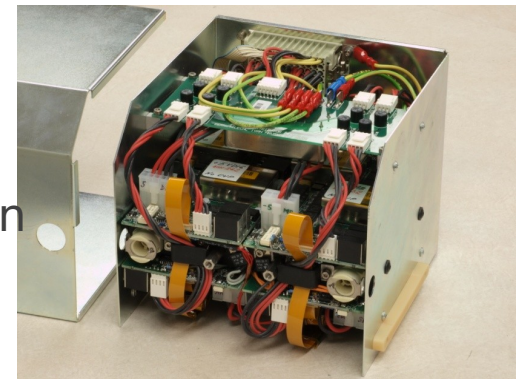
- Motivation for Re-Design
  - Catalogued Findings from Bench Studies at Argonne
  - 4 Critical Issues identified for redesign
    - ...Plus 5 "medium impact" issues and 5 "highly desirable" issues identified
    - See Summary slide for list
  - Prototype Development
    - Spring, 2009: Proposed development of a drop-in replacement
    - August, 2009: Produced 1st prototype, V7.0, quantity 1
    - December, 2009: Produced 2nd prototype, V7.1, quantity 10
      - Tested at CERN: QA test stand, long-term test over Christmas break
      - Testing includes: QA, Burn-in, Noise studies with Drawer Electronics,   Long-term stability
    - June 22, 2010: 1st Design Review
    - July, 2010: Will produce V7.2 → semifinal version
      - Addresses all known performance issues
    - December, 2010: ATLAS decision whether to build new LVPS bricks.

Design of a New Drop-In Replacement

Bricks from current LVPS in ATLAS Detector

New ANL Brick

⇨ *Same functionality*
⇨ *Same performance specifications*
⇨ *Retain the many good features of the old design*
⇨ *Improve reliability*

Timeline – Present through Feb., 2011 → Small Production Run of 25 Boxes

Summary of Design Changes

Improved Reliability

- **Critical Issues**
  - Reduce Noise..........................
  - Opto-Isolators..........................
  - Thermal Management.............
  - Better input protection of U2.....
- **Medium-Impact Issues**
  - Address stability.....................
  - Improve trip circuitry...............
  - Power sequencing.................
  - No kludges!...............................
  - Fabrication and soldering quality
  - Tantalum capacitors...............
- **Non-Critical But Highly Desirable**
  - Start-up Pulse current.............
  - Eliminate pre-loads................
  - Improve monitoring circuitry.....
  - IPC specs for assembly..........
  - Eliminate tuning OVP & OCP...

Improved Performance

- **What we have done:**
  - ⇨ More ground planes; improved filtering
  - ⇨ Filter supply & input pins
  - ⇨ U1 & U2 over cold plate; Use Gap Pad
  - ⇨ Add diode protection of inputs

  - ⇨ New fast-feedback design; Slow FB redesigned
  - ⇨ Simplify secondary; OVP & OCP Logical OR
  - ⇨ New regulator with programmable delay
  - ⇨ No kludges in production!
  - ⇨ Will use approved vendors
  - ⇨ Eliminate most; Use 35V caps on 15V sec. out.

  - ⇨ New regulator with programmable delay
  - ⇨ No preloads → New feedback design
  - ⇨ Differential techniques
  - ⇨ Design adheres to IPC specs
  - ⇨ Should be OK due to reduced noise

Funding will be requested this month, pending a final decision to proceed, in the ATLAS annual M&O budget process. If the decision is positive, construction will begin in early 2011 and installation will take place in 2012+

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TDAQ Maintenance and Operations

- **24 hour on-call at CERN for RoIB**
  - Shared between D. Fellmann, J. Zhang, A. Paramonov, R. Blair & Y. Ermoline
  - one failed mezzanine card (HOLA LDC)
  - so far no failures of the hardware built here
- **Software support for RoIB control and Level 2 supervisors**
  - work on making operations bullet proof by allowing for runtime reconfiguration of RoIB
  - updates to accommodate needed changes in API's for other parts of the system
- **Low level of activity investigating options for the future**
  - see next slides
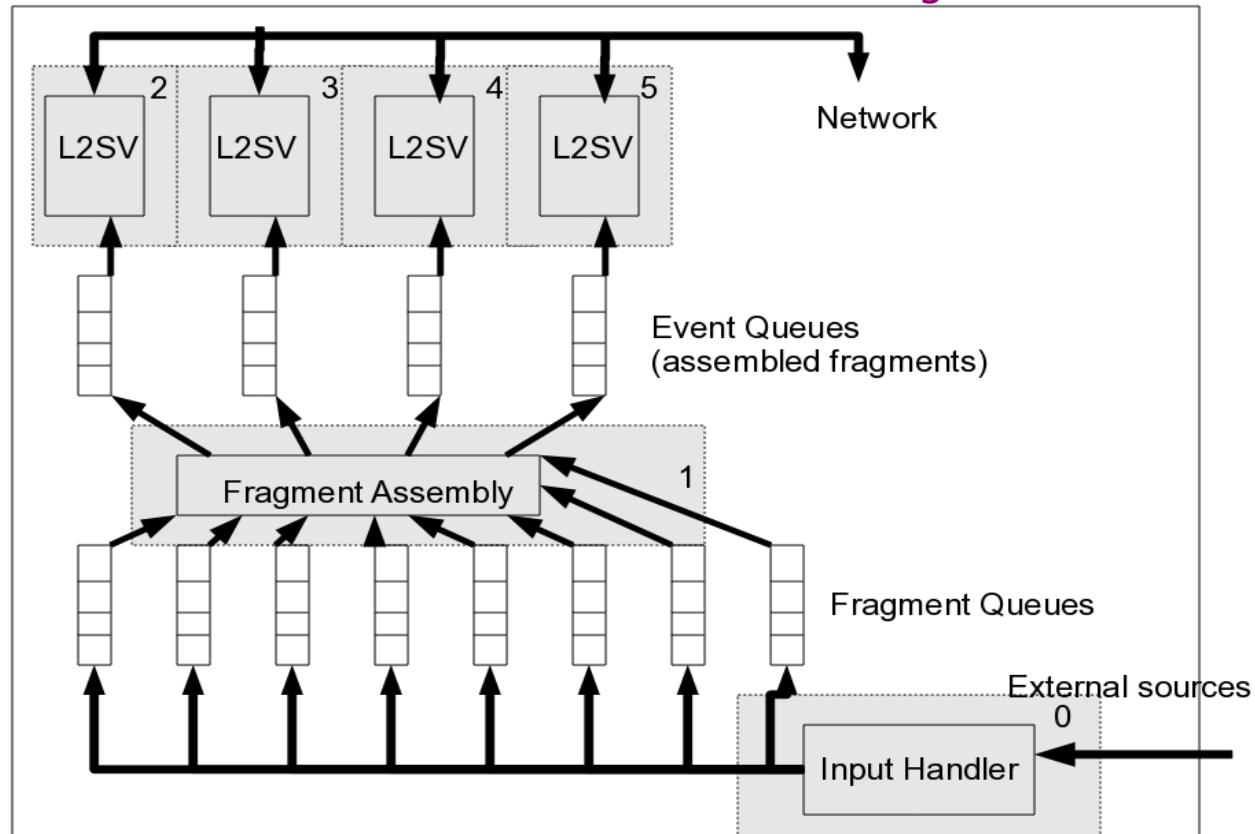
ATCA/Upgrade work for ATLAS

- History
  - assembly of LVL1 fragments was beyond the capabilities of commodity PC's at the time of initial design/deployment thus the VME RoI Builder
  - multicore architectures are the norm now and some rethinking is in order

- Tests
  - try consolidating supervisor functionality into a single box (PC) and include a fragment assembly function
- Short term
  - this might allow for a replacement for the existing RoIB which will be easier to support

ATCA/Upgrade work for ATLAS II

- Current setup
  - an ATCA shelf with two processor blades and a switch
  - the VME RoIB
  - 4 support PC's
- Status
  - setting up the system
  - modifying TDAQ software to accommodate the assembly task using ethernet input

- Future (looking beyond the current ATLAS TDAQ toward the next generation)
  - Explore at what level with specialized hardware one can assemble on the fly
    - LVL1 fragments
    - LVL1 RoI data
    - full event data for processing at all levels

Recent Notes (2010)
COM ("Communications")
CONF ("Conference") Notes
Conference Proceedings

All these ones have major contributions from division members

List (I)

- Performance of the Minimum Bias Trigger in p-p Collisions at sqrt{s} = 7 TeV,
  - ATL-COM-DAQ-2010-087
- Performance of the Minimum Bias Trigger in p-p Collisions at Sqrt(S) = 7 TeV
  - ATL-COM-DAQ-2010-083
- pi0 Mass with Topological Calorimeter Clusters in ATLAS Data at 900 GeV and 7 TeV
  - ATL-COM-PHYS-2010-351
- Alternative cell energy density jet calibration strategy for the ATLAS detector
  - ATL-COM-PHYS-2010-304
- Track Reconstruction Efficiency in 900 GeV Data,
  - ATL-COM-INDET-2010-010
- Atlas Muon Trigger Performance on cosmics and p-p collisions at $\sqrt{s} = 900$ GeV
  - ATLAS-COM-CONF-2010-013
- ATLAS Data Acquisition
  - ATL-DAQ-PROC-2010-005

List (II)

- Studies of particle flow using calorimeter clusters in pp collisions at 900 GeV and 7 TeV with the ATLAS detector at the LHC
  - ATL-COM-PHYS-2010-440
- Jet energy scale and its systematic uncertainty in ATLAS for jets produced in proton-proton collisions at sqrt s=7 TeV
  - ATL-COM-PHYS-2010-404
- Soft QCD Measurements at 900 GeV and 7 TeV with ATLAS
  - ATL-COM-PHYS-2010-376
- Underlying event particle flow based on calorimeter clusters in pp collisions at 7 TeV with the ATLAS detector at the LHC
  - ATL-COM-PHYS-2010-293
- Track-based underlying event measurements in pp collisions at sqrt{s} = 900 GeV and 7 TeV with the ATLAS Detector at the LHC
  - ATLAS-COM-CONF-2010-029
- Track-based underlying event measurements in pp collisions at sqrt{s} = 7 TeV with the ATLAS Detector at the LHC
  - ATL-COM-PHYS-2010-237
- Underlying event particle flow based on calorimeter clusters in pp collisions at 900 GeV with the ATLAS detector at the LHC
  - ATL-COM-PHYS-2010-210

List (III)

- Track-based underlying event measurements in pp collisions at sqrt{s} = 900 GeV with the ATLAS Detector at the LHC
  - ATL-COM-PHYS-2010-175
- Using bin-by-bin corrections for track-based underlying event measurements in pp collisions at 900 GeV
  - ATL-COM-PHYS-2010-165
- Searches for TeV-scale particles at the LHC using jet substructure
  - ATL-COM-PHYS-2010-035
- A Layer Correlation technique for pion energy calibration at the 2004 ATLAS Combined Beam Test
  - ATL-COM-CAL-2010-006
- Response and Shower Topology of 2 to 180 GeV Pions Measured with the ATLAS Barrel Calorimeter at the CERN Test-beam and Comparison to Monte Carlo Simulations
  - ATL-COM-CAL-2010-004
- Databases in LHC Experiments: Usage and Lessons Learned : Invited talk at the SuperB Computing R&D Workshop, March 9-12, 2010, Ferrara, Italy
  - ATL-COM-SOFT-2010-010
- Performance of the Minimum Bias Trigger in p-p Collisions at Sqrt(s) = 900 GeV
  - ATLAS-COM-CONF-2010-025

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List (IV)

- Job optimization in ATLAS TAG-based distributed analysis, M Mambelli , J Cranshaw , R Gardner , T Maeno , D Malon and M Novak

  2010 J. Phys.: Conf. Ser. 219 072042 doi: 10.1088/1742-6596/219/7/072042

- Event selection services in ATLAS , J Cranshaw , T Cuhadar-Donszelmann , E Gallas , J Hrivnac , M Kenyon , H McGlone , D Malon , M Mambelli , M Nowak , F Viegas , E Vinek and Q Zhang

  2010 J. Phys.: Conf. Ser. 219 042007 doi: 10.1088/1742-6596/219/4/042007

- New developments in file-based infrastructure for ATLAS event selection, P van Gemmeren , D M Malon and M Nowak

  2010 J. Phys.: Conf. Ser. 219 032061 doi: 10.1088/1742-6596/219/3/032061

- Petaminer: Using ROOT for efficient data storage in MySQL database, J Cranshaw , D Malon , A Vaniachine , V Fine , J Lauret and P Hamill

  2010 J. Phys.: Conf. Ser. 219 042036 doi: 10.1088/1742-6596/219/4/042036

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